CHAPTER 3: THREATS AND ACTIONS FOR FOCAL WILDLIFE & HABITATS

This State Wildlife Action Plan is made necessary and relevant by the number of New Jersey's wildlife species that face threats that could jeopardize their continued existence in the state and beyond. At the same time, actions to address these threats are directed at aiding species recovery to the point that they no longer need to be officially listed or keeping them from declining to the point where they would need to be listed. The following sections provide an overview of the wide-ranging threats facing New Jersey's wildlife and their habitats, needed research and outreach to guide conservation efforts, referred to as "action drivers," and conservation actions to ameliorate the threats and address the action drivers.

In this plan, information on threats and related actions is presented in three formats to help users of the plan develop and implement conservation projects that also fulfill their agency's or organization's mission. First, detailed lists of threats and action drivers (hereafter simply called threats) and conservation actions are provided in Appendices H and I, respectively. These lists provide the base information needed to develop projects focused on the conservation of SGCN and their habitats. In addition, the DFW has prepared two reports that present threats and associated conservation actions as they apply to the 48 individual Focal SGCN and Focal SGCN guilds (Appendix J: *Threats to and Conservation Actions for the Focal Species of Greatest Conservation Need*) and broader conservation issues (Appendix K: *Projects to Conserve New Jersey's Wildlife Populations of Concern*). Both are described below and should assist conservation partners in tailoring their conservation efforts to achieve the greatest benefits for New Jersey's imperiled wildlife.

I. Overview of Threats to Wildlife and Their Habitats

A. Building a Common Lexicon to Characterize Regional and Statewide Threats

Like the ranges of wildlife species themselves, the threats affecting SGCN commonly go well beyond the borders of individual states. As such, the actions needed to address these threats may be best accomplished through coordinated regional efforts. In the past, disparities in the language that individual states used to characterize threats to their SGCN impeded regional collaboration. Therefore, for this round of State Wildlife Planning, New Jersey and other Northeastern states agreed to use common lexicons for describing threats and developing actions to address them. The use of a common lexicon will enable the creation of a regional threats database that can help identify the most severe, pervasive or ubiquitous threats in the northeast. Such a database will foster efforts to address regional conservation needs and collaboration among states, which can pool their resources and expertise to maximize conservation gain.

The common threats lexicon for the Northeastern states follows the International Union for the Conservation of Nature's (IUCN) threats classification scheme. The IUCN lexicon consists of 11 primary categories of threats, which are then subdivided into secondary and tertiary sub-categories of increasing detail. In using the IUCN lexicon to identify threats in its Wildlife Action Plan, New Jersey will derive all the benefits discussed above. Users of the plan should note, however, that in deferring to a standard (and - in this case - "international") lexicon as the

standard framework within which to categorize threats, there will be some inherent shortcomings. For example, the DFW decided not to use the IUCN's "Geological Events" category because they were highly unlikely to affect the state's wildlife (it included, for example earthquakes, tsunamis, avalanches, and landslides). In addition, many second or third level IUCN threat categories were retained, despite perhaps having only minor relevance to New Jersey's SGCN. Certain "scale" modifiers contained in the IUCN lexicon were also poorly defined or perhaps not applicable in New Jersey. These factors need to be understood and considered when reviewing the threats identified in this Plan.

Threats can also be viewed as factors that drive the need for conservation action. Therefore, the Northeastern states also considered the "action drivers" identified by the U.S. Fish & Wildlife Service in their Tracking and Reporting on Actions for Conservation of Species (TRACS) database as a meaningful way to expand the IUCN threat categories. Through this assessment, the DFW added three TRACS action-driver categories to the 10 IUCN primary threats categories: "Resource Management Needs" and "Education & Outreach Needs." The 13 resulting threat and action driver categories are summarized in Table 2, and throughout the remainder of the plan are simply referred to as "threats."

Table 2. Major Threats & Action-Driver Categories

The numbers below relate to those in the IUCN and TRACS lexicons, so are not sequential. Categories 1-9 and 11 are threats based on the IUCN Lexicon, while categories 12, 14, and 15 are action drivers based on the TRACS Lexicon.

Category	Threat/Action Driver
1	Residential & Commercial Development
2	Agriculture & Aquaculture
3	Energy Production & Mining
4	Transportation & Service Corridors
5	Biological Resource Use
6	Human Intrusions and Disturbance
7	Natural Systems Modifications
8	Invasive & Other Problematic Species, Genes, & Diseases
9	Pollution
11	Climate Change & Severe Weather
12	Resource Management Needs
14	Education & Outreach Needs
15	Administrative Needs

The DFW worked with conservation partners and wildlife experts to organize finer scale threats into each of the 13 major categories. The resulting hierarchy organizes threats into four tiered levels of increasing detail, with level 4 containing New Jersey-specific threats to further clarify how the IUCN and TRACS categories apply specifically to New Jersey's wildlife and habitats.

A final note about "threats": The primary purpose of New Jersey's state Wildlife Action Plan is to identify the *actions* that must be taken to conserve *any one* of the 107 focal species or species groups addressed in the Plan. In order to identify such actions, it is necessary to identify the *specific threats* to each of these individual species or species groups. Threats to any single wildlife species vary greatly, and it is important to understand that activities, events or conditions that serve as a "threat" to one species or species group could benefit, or serve as a "conservation action," for another. For example, "forestry activities" may be listed as a threat when considered in the context of potential impacts associated with poorly timed or implemented forestry practices, or in regard to retention of certain forest structure or condition necessary for an individual focal species. However, forestry activities are more often a critically important *action* necessary to ensure that a broad array of other focal species or species groups are supported by a healthy and diverse age class of forest habitats, have specific vegetative species available, or experience specific conditions in the sub-canopy or forest floor that are critical for their survival. To arrive at all meaningful actions, it is important that all activities, events or conditions that can adversely impact certain wildlife species be recognized as threats. But it is equally important that users of the plan understand these characterizations are relative to some specific combination of species/habitats/conservation issues. Switching the focus to a separate species, habitat context, or conservation issue may, in turn, *completely* alter an activity, event or condition's characterization as a "threat."

In a similar vein, certain activities, events or conditions perceived as being beneficial or necessary for *society* may also be characterized in the Wildlife Action Plan as a "threat." For example, "agriculture and aquaculture" are identified as an IUCN threat category. Here, the plan merely recognizes that – *for specific species or species groups, and perhaps even limited to particular habitats or regions of the State* – these activities, conditions or associated side effects, do in fact result in adverse impacts for that specific species, their habitats or life history needs. Designation as a "threat" does *not* imply that these activities are universally adverse to all wildlife, nor that they are bad for humankind. Designation of activities, events or conditions as "threats" has no derogatory intent -- it merely reflects some factual association with impacts to certain wildlife species or habitats. Again, "threats" (and "actions") must be considered and understood in the context of specific species or species groups, and/or a specific habitat, and/or a specific conservation concern.

B. Evaluation of Threats

Using the 107 Focal SGCN as representatives of New Jersey's wildlife, DFW teams of taxa experts assessed how each of the threats related specifically to each species. They used a qualitative, expert-opinion-based approach that considered six threat characteristics[5] for each Focal SGCN: severity, reversibility, immediacy, spatial extent, certainty, and likelihood of impact in the next 10 years. These characteristics were used to assign a summary impact rating for each of the

[5] Crisfield, E. and the Northeast Fish and Wildlife Diversity Technical Committee (NEFWDTC). 2013

Focal SGCN: "high (3)," "moderate (2)," or "low (1)." A rating of "not applicable (0)" was given if the category posed no or an insignificant threat to the species. These ratings were then used to identify the threats that required immediate or near-term conservation actions. This information was used to generate the report, *Threats to and Conservation Actions for the Focal Species of Greatest Conservation Need* (which is further described in Section III of this chapter and is presented in Appendix J). The ratings were further used to identify the conservation actions that will have the greatest impact on wildlife in the next 10 years, as described in Section II below.

C. Threats Summary

After rating the threats to each Focal SGCN, the DFW grouped the Focal SGCN into three categories: marine (with 10 species), non-marine aquatic (with 25 species), and terrestrial (with 72 species). Then, for each level-3 threat category, the DFW determined the "threat frequency" (percentage of species within each of the three groups for which the threat category applied) and "threat severity" (the average impact rating for those species to which the threat category applied). A set of parameters were used for each group to refine the list of threats to those of greatest concern.[6] This distillation resulted in the 68 threat categories presented in Table 3.

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- Marine Group: Threat frequency ≥90% of species with average threat severity ≥1.5 or average Threat severity score ≥2.5
- Non-marine aquatic group: Threat frequency ≥90% of species with average threat severity ≥1.5 or average Threat severity score ≥2.5
- Terrestrial group: Threat frequency ≥80%* of species with average threat severity ≥1.5 or average Threat severity score ≥2.5

*A lower threat frequency value was applied to the terrestrial group as the group contains multiple species guilds with more varied life history requirements and consequently more varied threats and action drivers.

Table 3. Summary of the most ubiquitous and severe threats to New Jersey's wildlife and their habitats.

IUCN Level3 ID	IUCN Level 3 Category	IUCN Level 3 Category Definition/Description	Actions: TRACS Level3 ID
1.1.1	Land conversion from natural habitat to urban and other residential areas (large and small scale)	Habitat loss, fragmentation, and degradation (including wildlife travel corridors) associated with habitat conversion to housing and associated infrastructure and traffic.	1.2.1, 2.9.2, 2.10.0, 2.11.0, 2.12.1, 2.12.2, 2.12.3, 2.12.7, 3.0.0, 3.2.0, 3.2.3, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 4.1.0, 6.0.0, 6.1.1, 6.3.0, 7.1.4, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 11.2.1, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.3.2, 100.4.0
1.2.1	Land conversion from natural habitat to commercial or industrial areas (large and small scale)	Habitat loss, fragmentation, and degradation (including wildlife travel corridors) resulting from habitat conversion to commercial or industrial use and associated infrastructure and traffic (Note: The conversion of natural landscapes to structures and infrastructure within military bases are included within this category).	1.2.1, 2.9.2, 2.10.0, 2.11.0, 2.12.1, 2.12.2, 2.12.3, 2.12.7, 3.0.0, 3.2.0, 3.2.3, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 4.1.0, 6.0.0, 6.1.1, 6.3.0, 7.1.4, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 11.2.1, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.3.2, 100.4.0
2.1.1	Shifting Agriculture	Changing the agricultural use of a land from one that can be beneficial to animals (e.g., hay fields, pastureland) if managed for target species to one of lesser or no use (e.g., intensive tree/shrub nurseries).	1.2.1, 2.1.1, 2.3.3, 2.9.1, 2.10.0, 2.11.0, 2.12.1, 2.12.2, 2.12.3, 2.12.7, 3.0.0, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 4.1.0, 6.0.0, 6.3.0, 6.4.0, 7.1.2, 7.1.4, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 11.2.1, 100.1.2, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.4.0
2.1.3	Agro-industry	Industrial-scale agriculture, including new or expansion of existing facilities that causes habitat loss, degradation and/or fragmentation.	1.2.1, 2.3.3, 2.9.1, 2.10.0, 2.11.0, 2.12.1, 2.12.2, 2.12.3, 2.12.7, 3.0.0, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 6.0.0, 6.3.0, 6.4.0, 7.1.2, 7.1.4, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 11.2.1, 11.2.2, 100.1.2, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.4.0
3.1.1	Distribution processes of petroleum and other liquid hydrocarbons	Placement of new facilities and pipelines or expansion of existing facilities and pipeline to develop, produce and/or distribute petroleum and other liquid hydrocarbons that causes habitat loss, degradation, and/or fragmentation.	1.2.1, 2.2.1, 2.10.0, 2.11.0, 2.12.1, 2.12.3, 3.0.0, 3.2.0, 3.2.3, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 6.0.0, 6.3.0, 7.1.2, 7.1.4, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 11.2.1, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.4.0
3.1.2	Natural gas distribution processes	Placement of new facilities and pipelines or expansion of existing facilities and pipelines to develop, produce and/or distribute natural gas that causes habitat loss, degradation, and/or fragmentation.	1.2.1, 2.10.0, 2.11.0, 2.12.1, 2.12.3, 3.0.0, 3.2.0, 3.2.3, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 6.0.0, 6.3.0, 7.1.2, 7.1.4, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 11.2.1, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.4.0
3.3.1	Wind Power	Placement of new facilities or expansion of existing facilities that causes habitat loss, degradation, and/or fragmentation and/or that leads to increased bird and bat fatalities within their movement corridors and foraging areas.	1.2.1, 2.10.0, 2.11.0, 2.12.1, 2.12.3, 3.0.0, 3.2.0, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 6.0.0, 6.3.0, 7.1.2, 7.1.4, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 11.2.1, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.4.0
3.4.0	Conventional Power Plants	Placement of new facilities or expansion of existing facilities that causes impacts to groundwater hydrology and/or alters the water temperature and/or pH of aquatic systems.	1.2.1, 2.10.0, 2.10.1, 2.11.0, 2.12.1, 2.12.2, 2.12.3, 2.12.6, 3.0.0, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 6.0.0, 6.3.0, 7.1.2, 7.1.4, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.2.0, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.4.0
4.1.2	Movement of cars and other vehicles on roads and railroads (large and small scale)	Vehicular traffic densities that increase wildlife mortality and disrupt movement corridors.	1.2.1, 2.2.1, 2.10.0, 2.11.0, 2.12.1, 2.12.3, 2.12.7, 3.0.0, 3.2.0, 3.2.3, 3.3.1, 3.5.3, 3.5.4, 6.0.0, 8.1.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 100.1.4, 100.3.0, 100.4.0

Table 3 (threats/action drivers) continued

IUCN Level3 ID	IUCN Level 3 Category	IUCN Level 3 Category Definition/Description	Actions: TRACS Level3 ID
4.2.2	Management of rights-of-way or communication tower facilities and/or their associated access roads	Managing the vegetation within and adjacent to the rights-of-way, communication tower facilities and/or their associated access roads in a manner that results in direct mortality of wildlife (e.g., mowing during ground-nesting birds' or reptiles nesting season) or the creation of unsuitable habitat or conditions (e.g., herbiciding important food plants for invertebrates).	1.2.1, 2.10.0, 2.11.0, 2.12.1, 2.12.2, 2.12.3, 2.13.0, 3.3.2, 3.5.3, 3.5.4, 6.0.0, 7.1.2, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 11.2.1, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.4.0
4.3.1	Movement of large ships in shipping lanes	Ship traffic densities that increase marine and freshwater species' mortality and/or disrupt movement corridors or migratory patterns.	1.2.1, 3.0.0, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 6.0.0, 6.3.0, 7.1.2, 7.1.3, 7.1.4, 8.1.0, 8.3.0, 9.3.1, 9.3.3, 11.1.1, 11.2.0, 100.1.3, 100.1.4, 100.3.0, 100.4.0
5.1.1	Intentional Use	Excessive or illegal collection of butterflies and other insects, the illegal collection of reptiles and amphibians and localized excessive beaver trapping.	1.2.1, 7.1.2, 7.1.3, 7.1.4, 8.1.0, 8.3.0, 9.3.1, 9.3.3, 100.3.0
5.1.3	Persecution/Control	Harming, killing or controlling the presence of species considered undesirable (e.g., snakes, bats, invertebrates) and similar-looking species (i.e., those species misidentified as an undesirable species).	1.2.1, 7.1.2, 7.1.3, 7.1.4, 8.1.0, 8.3.0, 9.3.1, 9.3.3, 100.3.0
5.4.2	Fishing and Harvesting of Aquatic Resources: Intentional Use (large scale)	Excessive harvest of aquatic animals or plants from public or private "lands" (i.e., aquatic systems) at a large-scale for commercial markets that leads to the loss or degradation of aquatic habitats and/or decline of aquatic species (e.g., excessive horseshoe crab harvest).	1.2.1, 2.2.5, 2.8.0, 2.10.0, 2.10.1, 2.11.0, 2.12.1, 2.12.2, 2.12.3, 2.12.6, 3.0.0, 3.2.0, 3.2.3, 3.3.1, 3.3.2, 3.5.1, 3.5.3, 3.5.4, 4.1.1, 6.3.0, 7.1.2, 7.1.3, 7.1.4, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.4.0
5.4.3	Fishing and Harvesting of Aquatic Resources: Unintentional effects (subsistence/small scale)	Includes unintended impacts to aquatic animals and/or vegetation as a result of small-scale/subsistence fishing/harvesting practices (e.g., diamond-backed terrapin by-catch within crab traps without excluder devices), the introduction of fishing-gear (e.g., line and hooks) into aquatic systems in which animals become entangled, injured or killed, the disruption of substrate/benthic habitat during trawling activities conducted as a result of product harvesting and/or scientific research.	1.2.1, 2.2.5, 2.8.0, 2.10.0, 2.10.1, 2.11.0, 2.12.1, 2.12.2, 2.12.3, 2.12.6, 3.0.0, 3.2.0, 3.2.3, 3.3.1, 3.3.2, 3.5.1, 3.5.3, 3.5.4, 4.1.1, 6.3.0, 7.1.2, 7.1.3, 7.1.4, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.4.0
5.4.4	Fishing and Harvesting of Aquatic Resources: Unintentional effects (large scale)	Includes unintended impacts to aquatic animals and/or vegetation as a result of large-scale/commercial fishing/harvesting practices (e.g., diamond-backed terrapin by-catch within crab traps without excluder devices), the introduction of fishing-gear (e.g., abandoned long lines, nets and hooks) into aquatic systems in which animals become entangled, injured or killed, the disruption of substrate/benthic habitat during commercial trawling activities.	1.2.1, 2.2.5, 2.8.0, 2.10.0, 2.10.1, 2.11.0, 2.12.1, 2.12.2, 2.12.3, 2.12.6, 3.0.0, 3.2.0, 3.2.3, 3.3.1, 3.3.2, 3.5.1, 3.5.3, 3.5.4, 4.1.1, 6.3.0, 7.1.2, 7.1.3, 7.1.4, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.4.0

Table 3 (threats/action drivers) continued

IUCN Level3 ID	IUCN Level 3 Category	IUCN Level 3 Category Definition/Description	Actions: TRACS Level3 ID
6.1.1	Off-road vehicles (motorized and non-motorized)	Vehicle use in natural landscapes that leads to the loss or degradation of habitat and/or aquatic systems and the decline of associated terrestrial and aquatic wildlife through habitat degradation and/or direct mortality (e.g., vehicles driving over dunes or through streams increase erosion and sediment threats degrading the habitat for beach nesting birds and aquatic wildlife, respectively, increase the spread of invasive plants which can alter the natural ecosystem, etc.).	1.2.1, 2.9.1, 2.9.3, 2.10.0, 3.2.0, 3.3.1, 3.5.3, 3.5.4, 5.15.6, 7.1.2, 7.1.3, 7.1.4, 8.1.0, 8.3.0, 9.2.1, 9.3.1, 9.3.3, 11.1.1, 11.2.0, 100.1.4, 100.3.0
6.1.2	Boating	Recreational boating within sensitive wildlife areas that cause the disruption of waterbird colonies, other nesting habitats, or roosting areas.	1.2.1, 2.9.1, 2.9.3, 3.2.0, 3.3.1, 3.5.3, 3.5.4, 7.1.2, 7.1.3, 7.1.4, 8.1.0, 8.3.0, 9.3.1, 9.3.3, 11.1.1, 100.3.0, 100.4.0
6.1.3	Use of beaches	Pedestrian and dog activities within sensitive beach habitats that cause the disruption of nesting, roosting, foraging birds on beaches.	1.2.1, 2.9.1, 2.9.3, 3.3.1, 3.5.3, 3.5.4, 7.1.2, 7.1.3, 7.1.4, 8.1.0, 8.3.0, 9.3.1, 9.3.3, 11.1.1, 11.2.0, 11.2.1, 100.1.4, 100.3.0
6.3.2	Authorized research projects at significant habitats	Includes excessive trampling impacts of rare natural communities, ground-nesting wildlife (birds, reptiles), and aquatic breeders such as amphibians, fish and mussels, and also the impacts of sonar use on marine wildlife.	1.2.1, 3.0.0, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 6.3.0, 7.1.2, 7.1.3, 7.1.4, 8.1.0, 8.3.0, 9.3.1, 9.3.3, 11.1.1, 11.2.0, 100.1.3, 100.1.5, 100.3.0
6.3.3	Other "work" unrelated to research	Includes maintenance and construction activities of structures such as bridges and dams that disturb or otherwise impact wildlife species using the structure to fulfill part of their life history requirements (e.g., breeding, roosting, etc.).	1.2.1, 3.0.0, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 6.3.0, 7.1.2, 7.1.3, 7.1.4, 8.1.0, 8.3.0, 9.3.1, 9.3.3, 11.1.1, 11.2.0, 11.2.1, 100.1.3, 100.1.5, 100.3.0, 100.4.0
7.1.2	Suppression of Fire Frequency/Intensity	Lack of fire in fire-dependent habitats resulting in the degradation or loss of native landscapes and associated wildlife.	1.2.1, 2.3.3, 2.10.0, 2.11.0, 3.0.0, 3.2.0, 3.3.2, 3.5.3, 3.5.4, 6.4.0, 7.1.2, 7.1.4, 8.1.0, 8.3.0, 9.3.1, 9.3.3, 11.1.1, 11.2.0, 11.2.1, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.4.0
7.2.1	Abstraction of Surface Water (domestic use)	Includes water diversion for domestic use; ditching, impounding, and stream channelization.	1.2.1, 2.9.1, 2.9.2, 2.10.0, 2.11.0, 2.12.1, 2.12.2, 2.12.3, 2.12.6, 2.12.7, 2.12.8, 2.13.0, 3.0.0, 3.2.0, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 6.4.0, 8.1.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.4.0
7.2.2	Abstraction of Surface Water (commercial use)	Includes water diversion for commercial use; ditching, impounding, stream channelization.	1.2.1, 2.9.1, 2.9.2, 2.10.0, 2.11.0, 2.12.1, 2.12.2, 2.12.3, 2.12.6, 2.12.7, 2.12.8, 2.13.0, 3.0.0, 3.2.0, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 8.1.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.4.0
7.2.3	Abstraction of Surface Water (agricultural use)	Includes water diversion for agricultural use; ditching, impounding, stream channelization.	1.2.1, 2.9.1, 2.9.2, 2.10.0, 2.11.0, 2.12.1, 2.12.2, 2.12.3, 2.12.6, 2.12.7, 2.12.8, 2.13.0, 3.0.0, 3.2.0, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 8.1.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.4.0
7.2.5	Abstraction of Ground Water (domestic use)	Disrupting and/or permanently altering groundwater hydrology in support of the construction of residential developments.	1.2.1, 2.9.2, 2.10.0, 2.11.0, 2.12.1, 2.12.2, 2.12.3, 2.12.5, 2.12.6, 2.12.7, 8.1.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 100.1.3, 100.1.4, 100.1.5, 100.3.0

Table 3 (threats/action drivers) continued

IUCN Level3 ID	IUCN Level 3 Category	IUCN Level 3 Category Definition/Description	Actions: TRACS Level3 ID
7.2.6	Abstraction of Ground Water (commercial use)	Disrupting and/or permanently altering groundwater hydrology in support of mining operations, hydrofracturing or other commercial activities (excluding development).	1.2.1, 2.9.2, 2.10.0, 2.11.0, 2.12.1, 2.12.2, 2.12.3, 2.12.5, 2.12.6, 2.12.7, 8.1.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 100.1.3, 100.1.4, 100.1.5, 100.3.0
7.2.7	Abstraction of Ground Water (agricultural use)	Disrupting and/or permanently altering groundwater hydrology as a result of pumping water for irrigation.	1.2.1, 2.9.2, 2.10.0, 2.11.0, 2.12.1, 2.12.2, 2.12.3, 2.12.5, 2.12.6, 2.12.7, 8.1.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 100.1.3, 100.1.4, 100.1.5, 100.3.0
7.2.9	Small Dams	Altering the physical, biological and chemical environment of streams and rivers as a result of installing small dams and/or conducting periodic dam-associated draw downs. For the purposes of NJ's SWAP, a "small dam" is considered to be any dam similarly defined in New Jersey's Dam Safety Standards, N.J.A.C. 7:20, June 16, 2008, i.e., any dam that impounds <15 acre-feet of water to the top of the dam, has less than 15 ft height of dam, and has a drainage area above the dam of 150 acres or less.	1.2.1, 2.2.5, 3.0.0, 8.1.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 100.3.0
7.2.10	Large Dams	Altering the physical, biological and chemical environment of streams and rivers as a result of installing large dams and/or conducting periodic dam-associated draw downs. For the purpose of NJ's SWAP, a "large" dam" is considered to be any dam greater in structure size, volume of water retention or size drainage area above the dam than would otherwise meet the definition of a "small dam" used herein (and as is similarly defined at N.J.A.C. 7:20, Dam Safety Standards, June 16, 2008).	1.2.1, 2.2.5, 3.0.0, 8.1.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 100.3.0
7.2.11	Dams (size unknown)	Altering the physical, biological and chemical environment of streams and rivers as a result of installing dams (of a size that does not qualify as "small" or "large") and/or conducting periodic dam-associated draw downs.	1.2.1, 2.2.5, 3.0.0, 8.1.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 100.3.0
7.2.12	Culverts	Placement or improper management of culverts that create barriers to terrestrial and/or aquatic organisms rather than assist their safe dispersal.	1.2.1, 2.2.1, 2.2.5, 2.9.2, 3.0.0, 8.1.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.4.0
7.2.13	Stream Burial	Loss of headwater and/or intermittent streams as a result of stream burial.	1.2.1, 8.1.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 100.1.3, 100.1.4, 100.1.5, 100.3.0
7.3.1	Shoreline Stabilization	Installation of rip-rap, jetties, bulkheads, groins, etc. that alters the behavior of or otherwise impacts beach and marine wildlife. Installation of rip-rap, gabion and bulkheads on freshwater lakes and streams impacting freshwater aquatic and semi-aquatic species.	1.2.1, 2.1.1, 2.6.6, 2.9.1, 2.9.2, 2.9.3, 2.12.2, 3.3.1, 3.3.2, 4.1.1, 7.1.2, 8.1.0, 8.3.0, 9.3.1, 9.3.3, 11.1.1, 11.2.0, 11.2.1, 100.3.0
7.3.2	Inappropriate timing of mowing	Managing roadsides, rights-of-way, hay and other fields, etc. through mowing at times that increase the risk of disturbance and/or direct mortality to ground nesting/breeding birds, reptiles, small mammals and invertebrates.	1.2.1, 2.10.0, 2.11.0, 3.3.2, 3.5.3, 4.1.0, 6.0.0, 6.3.0, 7.1.2, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 11.2.1, 11.2.2, 100.1.2, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.4.0

Table 3 (threats/action drivers) continued

IUCN Level3 ID	IUCN Level 3 Category	IUCN Level 3 Category Definition/Description	Actions: TRACS Level3 ID
7.3.3	Removal of coarse woody debris (streams, forests, scrub-shrub habitats)	Removing woody debris that could otherwise provide shelter, nesting and foraging habitat for birds, reptiles and amphibians, and small mammals.	1.2.1, 2.3.2, 2.10.0, 2.11.0, 3.2.0, 3.3.2, 3.5.3, 4.1.0, 6.0.0, 6.3.0, 6.4.0, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 11.2.1, 11.2.2, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.4.0
7.3.5	Poor habitat management	Managing habitats and aquatic systems in a manner that is not beneficial to, and may cause harm and/decline of, the wildlife inhabitants and/or native plant communities.	1.2.1, 2.1.1, 2.3.2, 2.3.3, 2.8.0, 2.9.1, 2.9.3, 2.10.0, 2.10.1, 2.11.0, 2.12.1, 2.12.2, 2.12.3, 2.12.5, 2.12.6, 2.12.7, 2.12.8, 3.0.0, 3.2.0, 3.2.3, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 4.1.0, 6.0.0, 6.3.0, 6.4.0, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 11.2.1, 11.2.2, 100.1.2, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.4.0
8.1.4	Invasive non-native terrestrial/wetland animals	Non-native, terrestrial and/or wetland-associated animals that have a detrimental impact on the natural ecosystem by damaging or causing change in the native vegetation (and potential food source), hydrology and/or a decline of native aquatic animals. Examples include feral cats, gypsy moth, Asian long-horned beetle (Anoplophora glabripennis), emerald ash borer (Agrilus planipennis), and hemlock wooly adelgid (Adelges tsugae), European starlings (Sturnus vulgaris) and house wrens.	1.2.1, 2.8.0, 2.13.0, 3.2.0, 3.3.1, 3.3.2, 3.5.4, 7.1.4, 8.1.0, 8.3.0, 9.3.1, 9.3.3, 11.1.1, 11.2.0, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.4.0
8.1.6	Invasive non-native fungal/bacterial diseases	Non-native fungal and bacterial diseases that infect and have a detrimental impact on native wildlife and/or their habitats. Examples of such diseases include chytrid fungus (Batrachochytrium dendrobatidis) and Pseudogymnoascus destructans which causes white-nose syndrome in bats, and Sudden Oak Death fungus (Phytophthora ramorum).	1.2.1, 2.8.0, 2.13.0, 2.14.0, 3.2.0, 3.3.1, 3.5.3, 3.5.4, 8.1.0, 8.3.0, 9.3.1, 9.3.3, 11.1.1, 100.1.3, 100.1.5, 100.3.0, 100.4.0
8.3.0	Introduced Genetic Material	Human-induced hybridization or genetic dilution through direct introduction of species from another region or indirect introduction from habitat modification creating habitat connectivity that naturally would not have occurred otherwise.	1.2.1, 2.13.0, 3.0.0, 3.2.0, 3.2.3, 3.2.5, 3.5.4, 8.1.0, 9.3.1, 9.3.3, 100.1.5, 100.3.0, 100.4.0
8.5.2	Named Species (Disease)	Includes West Nile Virus, arenavirus, sudden oak death, Avian Influenza.	1.2.1, 2.8.0, 2.13.0, 2.14.0, 3.2.0, 3.3.1, 3.5.3, 3.5.4, 8.1.0, 9.3.1, 9.3.3, 11.1.1, 100.1.3, 100.1.5, 100.3.0, 100.4.0
9.1.1	Sewage	Habitat is degraded and/or animals are harmed or killed as a result of leaking septic systems, discharge from municipal wastewater treatment plants, untreated sewage.	1.2.1, 2.10.0, 2.11.0, 3.0.0, 3.2.0, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 7.1.4, 8.1.0, 9.3.1, 9.3.3, 11.2.0, 100.1.3, 100.1.4, 100.3.0, 100.4.0
9.1.2	Run-off	Habitat is degraded and/or animals are harmed or killed as a result of runoff of oil and sediment from roads, chemicals from roads and lawns, road salt, golf course chemicals, etc. into adjacent aquatic and terrestrial habitats.	1.2.1, 2.8.0, 2.10.0, 2.11.0, 3.0.0, 3.2.0, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 7.1.4, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.2.0, 100.1.3, 100.1.4, 100.3.0, 100.4.0

Table 3 (threats/action drivers) continued

IUCN Level3 ID	IUCN Level 3 Category	IUCN Level 3 Category Definition/Description	Actions: TRACS Level3 ID
9.2.1	Oil Spills	Habitat is degraded and/or animals are harmed or killed as a result of terrestrial and aquatic leakage from fuel tanks and spills from pipelines, and from PCBs in river sediments and the subsequent impacts of bioaccumulation of PCBs in the food web.	1.2.1, 2.10.0, 2.11.0, 3.3.2, 3.5.3, 8.1.0, 9.1.0, 9.3.1, 9.3.3, 11.1.1, 100.3.0, 100.4.0
9.2.2	Seepage from Mining	Includes acid mine drainage, mine tailings.	1.2.1, 2.10.0, 2.11.0, 3.0.0, 3.2.0, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 7.1.4, 8.1.0, 9.3.1, 9.3.3, 100.1.3, 100.3.0
9.2.3	Industrial and Military Effluents: Other	Other industrial pollutants impacting habitat and/or animals which are not specifically captured under the classification scheme such as toxic chemicals from factories, illegal dumping of chemicals, other industrial effluent, ship waste discharge, etc.	1.2.1, 2.10.0, 2.11.0, 3.0.0, 3.2.0, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 7.1.4, 8.1.0, 9.3.1, 9.3.3, 100.1.3, 100.3.0
9.3.1	Nutrient Loads	Aquatic and terrestrial environments become degraded or destroyed and/or animals are harmed as a result of nutrient loading from fertilizer run-off, manure from feedlots, nutrients from aquaculture, etc.	1.2.1, 2.10.0, 2.11.0, 3.0.0, 3.2.0, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 7.1.4, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.1.2, 11.2.0, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.4.0
9.3.2	Soil Erosion and Sedimentation	Aquatic and terrestrial environments become degraded or destroyed and/or animals are harmed as a result of soil erosion from overgrazing, increased run-off and hence sedimentation due to the conversion of forests (or other natural landscapes) to agricultural lands, etc.	1.2.1, 2.9.2, 2.10.0, 2.11.0, 2.12.1, 2.12.3, 2.12.7, 3.0.0, 3.2.0, 3.3.2, 3.5.1, 3.5.3, 3.5.4, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.2.0, 100.1.4, 100.3.0, 100.4.0
9.3.3	Herbicides and Pesticides	Herbicide, pesticides and fertilizer run-off from agricultural fields degrade or destroy adjacent aquatic and terrestrial habitats and/or cause harm to non-target species (plants and animals).	1.2.1, 2.8.0, 2.10.0, 2.11.0, 2.12.1, 2.12.3, 2.12.7, 3.0.0, 3.2.0, 3.3.2, 3.5.1, 3.5.3, 3.5.4, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.2.0, 100.1.4, 100.3.0, 100.4.0
9.3.4	Agricultural and Forestry Effluents: Other	Other agricultural and/or forestry management-related pollutants impacting habitat and/or animals which are not specifically captured under the classification scheme; identify type/source.	1.2.1, 2.10.0, 2.11.0, 2.12.1, 2.12.3, 2.12.7, 3.0.0, 3.2.0, 3.3.2, 3.5.1, 3.5.3, 3.5.4, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.2.0, 100.1.4, 100.3.0, 100.4.0
9.3.5	Control of insect pests and plants leading to mortality of non-target species not associated with agriculture	Herbicide and pesticides applied in environments through directional application (i.e., not aerial spraying) that lead to the harm of non-target species (plants and animals) such as the use of larvacides and adulticides for mosquito control that may harm amphibians and beneficial invertebrates.	1.2.1, 2.8.0, 2.11.0, 2.13.0, 3.2.0, 3.3.2, 3.5.3, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.2.0, 100.1.4, 100.3.0, 100.4.0
9.4.1	Direct hazards to wildlife	Includes waste that can harm or kill wildlife by entangling or strangling animals leading to their predation, starvation or fatal injury, causing fatal blockages in their digestive systems when waste is mistakenly eaten, etc., including but not limited to municipal solid waste, litter from cars and boats, waste that entangles or strangles wildlife, construction debris, etc.	1.2.1, 8.1.0, 8.3.0, 9.3.1, 9.3.3, 11.2.0, 100.1.4, 100.3.0, 100.4.0

Table 3 (threats/action drivers) continued

IUCN Level3 ID	IUCN Level 3 Category	IUCN Level 3 Category Definition/Description	Actions: TRACS Level3 ID
9.5.1	Acid Rain	Habitat and water quality degradation and/or the acidification of ocean water as a result of acid rain, excess nitrogen deposition, wind dispersion of pollutants or sediments, radioactive fallout, smoke from forest fires, etc.	1.2.1, 8.1.0, 9.3.1, 9.3.3, 100.3.0
9.5.6	Herbicides and Pesticides	Herbicide and pesticides applied to environments through aerial application that lead to the harm of non-target species (plants and animals) such as the aerial application of chemicals to control pests, such as gypsy moths, mosquitos.	1.2.1, 2.8.0, 3.0.0, 3.3.2, 3.5.3, 8.1.0, 9.3.1, 9.3.3, 100.3.0
9.6.3	Noise Pollution	Noise that causes changes in animal behavior that may result in injury, death, failed reproduction, or detrimental shifts in migratory patterns such as noise from highways or airplanes, sonar from submarines that disturb whales, the construction activities associated with offshore wind and other energy development, etc.	1.2.1, 3.2.0, 3.3.1, 3.5.3, 3.5.4, 5.15.6, 7.1.2, 7.1.3, 7.1.4, 8.1.0, 8.3.0, 9.2.1, 9.3.1, 9.3.3, 11.1.1, 11.2.0, 11.2.1, 100.1.4, 100.3.0
11.1.0	Macro- and Micro-Climate Alterations	Permanent changes in macro- and micro-habitat conditions that reduce habitat suitability for habitat specialist or niche species.	1.2.1, 2.1.1, 2.9.1, 2.9.3, 2.10.0, 2.11.0, 2.12.1, 2.12.2, 2.12.3, 2.12.6, 2.12.7, 3.0.0, 3.2.0, 3.3.1, 3.5.3, 4.1.1, 6.0.0, 8.1.0, 9.3.1, 9.3.3, 100.3.0
11.2.1	Droughts	Increased periods and/or frequency of droughts leading to changes in the hydrology of aquatic systems and ground water and subsequent loss/alteration of aquatic and terrestrial habitats, the elimination of small wetlands and streams, etc., and subsequent impacts or loss of animals dependent on such habitat such as freshwater mussels.	1.2.1, 2.10.0, 2.11.0, 2.12.1, 2.12.2, 2.12.3, 2.12.5, 2.12.6, 2.12.7, 3.0.0, 3.3.1, 3.5.3, 3.5.4, 4.1.1, 6.0.0, 6.3.0, 7.1.4, 8.1.0, 9.3.1, 9.3.3, 11.2.0, 100.1.4, 100.3.0
11.3.1	Temperature extremes	Periods of extreme temperature ranges (high or low) that lead to the loss of habitats, disrupts migratory patterns of both marine and terrestrial wildlife, reduces water flow in streams/rivers, increases water temperature and/or changes water pH which impacts aquatic animals, lowers the water level of wetlands, riverine, lacustrine and vernal pool habitats, and causes premature drying of vernal habitats.	1.2.1, 2.10.0, 2.11.0, 2.12.1, 2.12.2, 2.12.3, 2.12.5, 2.12.6, 2.12.7, 3.0.0, 3.3.1, 3.5.3, 3.5.4, 4.1.1, 6.0.0, 6.3.0, 7.1.4, 8.1.0, 9.3.1, 9.3.3, 11.2.0, 100.1.4, 100.3.0
11.4.1	Storms and flooding	Extreme flooding alters the hydrology of aquatic habitats and causes water quality degradation as a result of increased silt loads, stream bottom shifting and increased turbidity of streams and rivers. It also disrupts migratory patterns of both marine and terrestrial wildlife, and coastal flooding breaches existing natural sand berms along shores that normally limit tidal flooding events and cause conversion of "barrier wetlands" to open water or other natural communities.	1.2.1, 2.9.1, 2.9.2, 2.9.3, 2.10.0, 2.11.0, 2.12.1, 2.12.2, 2.12.3, 2.12.5, 2.12.6, 2.12.7, 3.0.0, 3.3.1, 3.5.3, 3.5.4, 4.1.1, 6.0.0, 6.1.1, 6.3.0, 7.1.4, 8.1.0, 8.3.0, 9.1.0, 9.3.1, 9.3.3, 11.2.0, 100.1.4, 100.3.0, 100.3.2

Table 3 (threats/action drivers) continued

IUCN Level3 ID	IUCN Level 3 Category	IUCN Level 3 Category Definition/Description	Actions: TRACS Level3 ID
11.6.3	Phenology shifts related to species redistribution	Changes in species distribution driven by climate-caused changes in species' ranges and/or competition.	1.2.1, 2.8.0, 2.13.0, 3.0.0, 3.2.0, 3.2.3, 3.2.5, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 4.1.1, 8.1.0, 8.3.0, 9.3.1, 9.3.3, 11.2.0, 100.1.5, 100.3.0, 100.4.0
12.1.1	Resource information collection needs: Lack of initial baseline inventory	Need to gather baseline data regarding fish, wildlife populations and/or habitat status, availability and condition as part of long-term trend analysis.	1.2.1, 2.8.0, 2.13.0, 3.0.0, 3.2.0, 3.2.3, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 8.1.0, 9.3.1, 9.3.3, 100.1.3, 100.3.0, 100.4.0
12.1.2	Resource information collection needs: Lack of up-to-date existing information	Need to conduct (routine, regular, ongoing) surveys/assessments to provide the up-to-date information regarding population trends or health, and/or status of fish, wildlife and/or their habitats.	1.2.1, 2.8.0, 2.14.0, 3.0.0, 3.2.0, 3.2.1, 3.2.2, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 8.1.0, 9.3.1, 9.3.3, 100.3.0, 100.4.0
12.1.3	Resource information collection needs: Need to answer research question	Need to address unanswered or unresolved conservation question(s) regarding fish/wildlife species, species suites and/or their habitats that will inform future conservation efforts and management decisions.	1.2.1, 2.4.2, 2.8.0, 2.13.0, 2.14.0, 3.0.0, 3.2.0, 3.2.3, 3.2.4, 3.2.5, 3.2.7, 3.3.1, 3.3.2, 3.5.1, 3.5.3, 3.5.4, 6.3.0, 8.1.0, 9.3.1, 9.3.3, 100.1.3, 100.3.0, 100.4.0
12.1.4	Resource information collection needs: Need to develop new technique	Need to develop and evaluate new species or habitat survey methods or techniques because current survey/assessment efforts fail to obtain the necessary data. Need to develop and evaluate new (species or habitat) management techniques.	1.2.1, 3.2.0, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 8.1.0, 9.3.1, 100.3.0
12.3.0	State Regulatory Reforms		1.2.1, 2.2.1, 2.10.0, 3.2.0, 3.3.1, 3.3.2, 3.5.3, 3.5.4, 6.0.0, 6.1.1, 6.3.0, 6.4.0, 7.1.2, 7.1.3, 7.1.4, 8.1.0, 9.1.0, 9.2.1, 9.3.1, 9.3.3, 11.1.1, 11.1.2, 11.2.0, 100.1.2, 100.1.3, 100.1.4, 100.1.5, 100.3.0, 100.3.2, 100.4.0
14.1.1	Education needs: Need for improved knowledge of fish and wildlife and their habitats	Lack of general knowledge or understanding (ecological literacy) of fish and wildlife and habitat conservation.	1.2.1, 3.3.1, 4.1.0, 4.1.1, 5.15.6, 8.1.0, 8.3.0, 9.2.1, 9.3.1, 11.2.0, 11.2.1, 11.2.2, 100.1.5, 100.3.0, 100.4.0
14.2.1	Outreach needs: Need to improve specific understanding of agency/organization goals, objectives and ongoing wildlife conservation actions	Need to develop greater understanding of and support for agency's/organization's conservation work among general public and constituent groups (i.e., conservation partners, government agencies, the general public, farmers, business, homeowners, recreationists).	1.2.1, 3.3.1, 3.5.4, 4.1.0, 4.1.1, 5.15.6, 8.1.0, 8.2.3, 8.3.0, 9.1.0, 9.2.1, 9.3.1, 9.3.3, 11.2.0, 11.2.1, 11.2.2, 100.1.5, 100.3.0, 100.4.0
15.2.3	Need for multi-state, regional and landscape scale planning	Needs that can only be achieved via coordination or action among states or regional conservation partners/stakeholders.	9.3.1

D. Future Evaluation and Ranking of Threats

The DFW intends to work with conservation partners to further evaluate threats from 2018 to 2020, so as new information and perspectives are assessed, these values, and consequently the lists, may change. Future evaluations of threats will consider the six threat characteristics independently (such as their severity, spatial extent, and tractability) with the goal of generating rankings that even more accurately represent the potential risk to Focal SGCN. The results of this intensive evaluation will be integrated into a revised report, *Threats and Actions of Focal Species of Greatest Conservation Need*, as part of a future revision to this plan.

E. The Compounding Threat of Climate Change

Consideration of the implications of climate change for SGCN is a requirement that the USFWS places on all State Wildlife Action Plan submittals. Further, climate change – perhaps more than any other threat – exacerbates the consequences of many other threats in addition to posing direct problems of its own. This section therefore discusses the current state and projections of climate change in New Jersey.

The current state of climate change in New Jersey

- In New Jersey, the average annual temperature has continued to rise over the past century. Climate data for a 122-year period between 1895 and 2016, published by the State Climatologist Office, Rutgers University, demonstrates a clear statewide warming trend. Notably, the five of the coldest average annual temperatures were recorded before 1941, while the five warmest were recorded after 1997.[7]
- While precipitation has been variable over the past century, New Jersey's average annual precipitation in the past four decades has exceeded that of the early 20th century.[8]
- Complex modeling led by Rutgers University indicates that sea level rise in the 20th century has been three times faster than at any time in the past 2,700 years.[9]
- Over the last 15 years, sea level rose, on average, 2" globally and 4" in New Jersey. Over the next 15 years, sea level is predicted to rise 3"-4" globally and 7"-12" in New Jersey. If greenhouse gas emissions remain the same, sea level could rise 24"-36" globally over the next century and 29"-54" along the New Jersey coast. If emissions are cut drastically, the century prediction could be reduced by 12" or so – meaning that New Jersey will have to contend with significant sea level rise even if changes were made immediately.[10]
- New Jersey's marshes are relatively flat, so 12" of sea level rise translates to the marsh moving 1,000' back. The Delaware Bay coast of New Jersey is especially vulnerable. At current rates, New Jersey will lose almost 3% of its landmass over the course of the next century to advancing waters.[11]
- The sea level rise trend for New Jersey is almost twice the global rate.[12]
- Increasing rates of carbon dioxide emissions (and the subsequent absorption of the carbon dioxide into the water) is leading to ocean acidification. The average pH has gone down by 0.1 since the Industrial Revolution. This represents a 25% change, and an even larger change is predicted in the next 10-50 years.[13]

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[7] Office of the NJ State Climatologist, 2016
[8] Broccoli *et al*, 2013
[9] Kopp *et al*, 2016
[10] Kopp et al., 2014
[11] Cooper et al., 2008
[12] Kopp et al., 2014
[13] NJCAA, 2014a

Future effects of climate change if climate change continues to accelerate

- Decreased air and water quality.[14]
- More severe "heat island" effects in New Jersey's urbanized landscapes.[15]
- Changes in forest species composition, with resulting shifts or losses of bird and wildlife habitat, migratory corridors and breeding areas.[16]
- More severe storms separated by increased periods of drought. This flashier storm cycle will result in more severe flooding, but also in less recharge of aquifers as storm water quickly runs off the hardened soils. These changes will increase stress on both natural and managed ecosystems across the state.[17]
- Substantial increases in the extent and frequency of storm surge, coastal flooding, erosion, property damage, and loss of wetlands along New Jersey's densely populated coasts. Sea level rise will exacerbate these problems.[18]
- Increased salt-water inundation into coastal aquifers that residents rely on for fresh water.[19]

Implications of climate change for New Jersey's wildlife and their habitats

- Loss of habitat as marshes and beaches disappear due to sea-level rise. If storms occur during breeding seasons, productivity could be reduced by more flooding and damaging winds. Conversely, overwash habitat can be created by major storms like hurricanes, but then compromised when humans attempt to re-stabilize an area, thus eliminating the positive benefit it would have had for some wildlife.[20]
- Diminished water recharge within watersheds could lead to decreased water availability for native vegetation, with consequent impacts on habitats and wildlife.[21]
- Shifts in the timing of migration and hibernation could put these critical life history events out of synch with the availability of important food resources, leading to mistimed reproduction and reduced population success.[22] For example, warmer springs have led to earlier nesting for 28 migrating bird species on the East Coast.[23]

[14] NOAA 2017
[15] Hoverter, 2012
[16] Pinchot Institute for Conservation, 2015; U.S.D.A. Forest Services, 2016.
[17] Sweet, *et al*, 2013
[18] USGCRP, 2009
[19] NJCAA, 2014b
[20] NWF and Manomet, 2014
[21] VanLuven, 2015
[22] Stenseth and Mysterud, 2002; Visser *et al*, 2004; Visser and Both, 2005
[23] Butler, 2003

- Increased periods of drought will lower water tables, altering wetlands that are critical for many of New Jersey's wildlife species that rely on them year-round or seasonally for resting, breeding, and feeding.[24]
- Warmer winter temperatures may result in an increase of invasive pathogens and insects that threaten the state's natural systems as many of these organisms are limited by cold winters. There are many cases where climate change has already affected or will affect forest-insect species' range and abundance.[25] Warming temperatures are expected to result in an expansion of suitable range and increase the probability of spruce beetle outbreaks.[26] Climate change also appears to be encouraging the expansion of other non-native insects, including hemlock wooly adelgid, gypsy moth, and southern pine beetle.[27] Research has also demonstrated the spread of two protozoan parasites from the Gulf of Mexico to Delaware Bay and farther north, resulting in mass mortalities of oysters.[28]
- Warming trends lead to changes in species compositions. In the ocean, for example, hake was once one of the most common fish species off New Jersey's coast. It has been replaced by black sea bass, which used to be most common off Virginia's coast.[29]
- Increasing amounts of carbon dioxide absorbed in the water leads to ocean acidification (lower pH) which changes nutrient availability, decreases oxygen levels, and impedes the ability of shellfish to thrive and grow strong shells.[30]

II. Conservation Actions for Wildlife and Their Habitats

A. Building a Common Lexicon to Enhance Local and Regional Actions

For the 2006 Plan, the DFW and conservation partners identified hundreds of conservation actions needed to address the many threats facing SGCN. For this revision, the DFW determined which of these actions needed to be revised for clarification or specificity, could be removed because they were no longer applicable to current conditions, or could be combined or condensed. The goal in this effort was to make the plan easier to use. The DFW also identified additional actions that could address more recent challenges, such as new wildlife diseases and a growing understanding of climate change.

All of these actions were categorized using the TRACS lexicon and are presented in Appendix I. To better address New Jersey's specific needs and SGCN priorities, the DFW removed some TRACS categories and created new ones. TRACS categories removed included those that were

[24] Brooks, 2009
[25] Ayres and Lombardero, 2000; Bale *et al*, 2002; Weed *et al*, 2013
[26] Logan and Powell, 2001; Logan, *et al*, 2003
[27] Parker *et al*, 1999; Logan *et al*, 2003; Tran *et al*, 2007
[28] Hoffmann *et al*., 2001
[29] Pinsky and Mantua, 2014
[30] NJ Dept of Environmental Protection 2013

not applicable in the state, did not focus on SGCN conservation, or were adequately addressed in other TRACS action categories. New categories were added to address voids in the lexicon.

The TRACS lexicon organizes actions into three tiered levels of increasing detail. As was done with threats and action drivers, the DFW introduced a fourth level containing even more detailed conservation actions specific to New Jersey.

B. Identifying the Actions Associated with the Most Important Threats

Action Development Workshops

In order to reflect on past successes and future needs as a conservation community, the DFW collaborated with the Conserve Wildlife Foundation of New Jersey to host three expert stakeholder workshops in July 2015. The workshops brought together participants to collaboratively identify the broad suite of actions that will guide conservation of New Jersey's SGCN for the next ten years.

An invitee list was generated by the ENSP, the NJ Plan's Executive Committee, and the Conserve Wildlife Foundation of New Jersey. It included more than 460 professionals from state and federal agencies, private organizations, research institutions, land trusts, and universities (all of whom are listed in Appendix L). Because of the wide breadth of knowledge and ground to cover (both topically and geographically), the DWF organized three separate professionally facilitated workshops that each centered on a focal theme or landscape that reflected the unique expertise and interests of the participants.

The first workshop focused on Policy & Planning actions with more than 50 people from 22 agencies and organizations. Discussions explored actions related to the ten IUCN primary threats categories.

The second workshop focused on Habitat Management and Land Protection actions with more than 65 people from 32 agencies and organizations. At this workshop, participants considered actions relating to general habitat types, such as forests, grasslands, and freshwater systems.

The third workshop focused on actions in the Marine Environment and involved more than 30 people from 15 agencies and organizations. Their discussions helped identify actions necessary for addressing threats to marine wildlife and habitats.

The actions presented at the workshops ranged from species- and habitat-specific issues to broader, more comprehensive conservation needs. Ultimately, they lent themselves to the creation of conservation projects that are described in section IV, *Projects to Conserve New Jersey's Wildlife Populations of Concern Report*, below. The participation of this wide array of conservation partners not only made this plan stronger and more comprehensive, it will also help focus limited resources on the actions that will yield the greatest benefits for New Jersey's SGCN.

Actions Distillation

In an effort to identify the conservation actions that would have the greatest impact on wildlife conservation over the next ten years, the DFW filtered the actions (which use the TRACS

lexicon) by identifying those associated with the distilled threats described and presented in section I.C of this chapter. This method, however, resulted in the selection of virtually all of the "level 3" action categories (Table 4).

While inclusive, the list shows the breadth of actions needed to conserve New Jersey's diverse wildlife. More specific species-focused guidance regarding conservation actions is presented in the report, *Threats and Conservation Actions for the Focal Species of Greatest Conservation Need* (Appendix J) and, in the context of broader conservation issues in the report, *Projects to Conserve New Jersey's Wildlife Populations of Concern* (Appendix K).

Table 4. Summary of conservation actions to address the most ubiquitous and severe threats to New Jersey's wildlife and their habitats.

TRACS Level3 ID	TRACS Level 3 Category	TRACS Level 3 Category Definition/Description
1.2.1	Incentives	Development and delivery of economic incentives to private landowners to influence responsible stewardship of land/water and specific species.
2.1.1	Habitat conversion	Conversion of one type of habitat into another (e.g., creating bottomland forest from agricultural land, wetland creation).
2.2.1	Culvert work	Replacement or repair of road culverts (e.g., installing larger culvert, eliminating perching).
2.2.5	Obstruction removal	Removal of other obstructions (e.g., beaver dams).
2.3.2	Fuel reduction	Application of treatments to reduce the risk of high-severity wildfires and to manage changes in the ecological functions of forests (e.g., mechanical thinning).
2.3.3	Prescribed burning	Application of fire in a knowledgeable manner to forest fuels on a specific land under selected weather conditions to accomplish predetermined, well-defined management objectives (e.g., burning an established native grass community to reduce or eliminate invading brush or exotic species).
2.4.2	Hibernacula	Creation or improvement of overwintering sites.
2.6.6	Shoreline armoring removal	Removal of shoreline armoring to improve aquatic habitats (e.g., jetties, riprap).
2.8.0	Invasive species control strategies and implementation	Control of invasive animal and plant species to maintain native species populations and restore ecological functions.
2.9.1	Beach renourishment	Placement of sand onto beaches and employing other techniques for their renourishment.
2.9.2	Erosion control structures	Installation of hard structures (e.g., seawall bulkhead) or living structures (e.g., greenwall systems) to control erosion.
2.9.3	Sand dune restoration	Application of techniques to restore sand dunes (e.g., fencing off sea-grass areas).
2.10.0	Planting/seeding strategies for terrestrial or aquatic habitat	Planting or seeding to maintain fish and wildlife habitats and/or restore ecological functions.

Table 4 (conservation actions) continued

TRACS Level3 ID	TRACS Level 3 Category	TRACS Level 3 Category Definition/Description
2.10.1	Coral	Application of techniques to reestablish coral reefs.
2.11.0	Vegetation management strategies for terrestrial or aquatic habitat	Physical manipulation of vegetation to maintain fish and wildlife habitats and/or restore ecological functions.
2.12.1	Water management: Ditch plugs	Installation of earthen plugs into drainage ditches to restore wetlands.
2.12.2	Water management: Diversion/headgate	Installation or maintenance of structures to divert water.
2.12.3	Water management: Drainage	Removal of tile drains or drainage ditches to restore wetland hydrology.
2.12.5	Water management: Spring development	Application of techniques to improve the flow, quantity and yield of water from a natural spring.
2.12.6	Water management: Tide gate	Installation or maintenance of structures to increase the hydro-period and water depth of a wetland.
2.12.7	Water management: Waterfowl impoundment maintenance	Maintenance of impoundments for waterfowl habitat (e.g., renovation of impoundment dikes).
2.12.8	Water management: Watering facilities	Installation or maintenance of structures to collect and store water for the benefit of wildlife (e.g., water holes, guzzlers, wells).
2.13.0	Nuisance fish and wildlife damage	Assessment and management of damage from nuisance native fish and wildlife, including the effects of predator control via biological, chemical or mechanical means.
2.14.0	Wildlife disease strategy development and investigation	Assessment and management of wildlife disease situations, including control or treatment of diseased animals to maintain populations of species at risk and restore ecological functions.
3.0.0	Research, survey or monitoring - general fish and wildlife needs	Research, survey or monitoring efforts to collect and analyze data regarding long-term or emerging needs of native fish or wildlife species and their habitats.
3.2.0	Research, survey or monitoring - fish and wildlife populations: Data deficiency	Collection and analysis of data as part of research, survey or monitoring primarily focused on fish and wildlife populations.
3.2.1	Research, survey or monitoring - fish and wildlife populations: Abundance determination	Determination of relative abundance or estimation of size of fish and wildlife populations (e.g., adult population estimate, juvenile relative abundance).
3.2.2	Research, survey or monitoring - fish and wildlife populations: Age, size and sex structure	Determination of age, size or sex structure of fish and wildlife populations (e.g., age and growth, length frequency, sex ratio).
3.2.3	Research, survey or monitoring - fish and wildlife populations: Baseline inventory	Baseline survey and inventory to understand distribution of fish and wildlife populations.
3.2.4	Research, survey or monitoring - fish and wildlife populations: Food habits	Studies on food habits of fish and wildlife species or their utilization as prey.

Table 4 (conservation actions) continued

TRACS Level3 ID	TRACS Level 3 Category	TRACS Level 3 Category Definition/Description
3.2.5	Research, survey or monitoring - fish and wildlife populations: Genetics	Genetics studies of fish and wildlife populations (e.g., population connectivity, hybridization).
3.2.7	Research, survey or monitoring - fish and wildlife populations: Population assessment	Assessments of biological information to determine status of fish and wildlife populations (e.g., population viability analysis, fisheries stock assessment).
3.3.1	Research, survey or monitoring - habitat: Baseline inventory	Baseline survey and inventory to understand distribution of fish and wildlife habitat quality and quantity (e.g., wetland mapping).
3.3.2	Research, survey or monitoring - habitat: Monitoring	On-going monitoring of fish and wildlife habitat quality and quantity (e.g., annual early successional habitat survey, artificial reef condition).
3.5.1	Artificial propagation studies	Research on artificial propagation of fish and wildlife (e.g., nutrition studies, culture methods).
3.5.3	Habitat restoration methods	Development or improvement of methods to restore habitats and natural processes (e.g., evaluations of water level fluctuations).
3.5.4	Fish and wildlife research, survey and management techniques	Development or improvement of research techniques or management tools (e.g., tag retention studies, sampling device improvements, testing of animal control devices).
4.1.0	Public education	Provide educational resources and training programs to private and public landowners, as well as schools, regarding the benefits and creation of backyard habitats for wildlife.
4.1.1	Aquatic resource education	Training of new instructors and teachers in aquatic resource education who will teach others Note: This includes teachers, nature center staff and camp counselors who attend ARE workshops, teachers who help the agency write curriculum, etc.
5.15.6	Wildlife Management Areas: Roads	Clearly post vehicular access restrictions of roads and trails on wildlife management areas.
6.0.0	Land and Water Rights Acquisition and Protection: Combined acquisition and protection strategies	Enhance and increase the effective size of fish and wildlife habitats by securing habitats through an appropriate combination of fee title, non-fee title and landowner agreements.
6.1.1	Land and Water Rights Acquisition and Protection: Fee title	Acquisition of lands through fee title acquisition.
6.3.0	Land and Water Rights Acquisition and Protection: Conservation area designation strategies	Designation of a site or landscape as having unique and important value to fish and wildlife with or without legal protections (e.g., waterfowl breeding area, Marine Protected Area).
6.4.0	Land and Water Rights Acquisition and Protection: Private land agreement strategies	Enter into private lands agreements to expand control burns on private lands, in particular those adjacent to conserved lands to improve SGCN habitats.
7.1.2	Law Enforcement: National Level	Enforcement of federal laws and regulations related to the protection of fish and wildlife or their habitats.
7.1.3	Law Enforcement: Sub-national Level	Enforcement of state or municipal laws and regulations related to the protection of fish and wildlife or their habitats.

Table 4 (conservation actions) continued

TRACS Level3 ID	TRACS Level 3 Category	TRACS Level 3 Category Definition/Description
7.1.4	Law Enforcement: Scale Unspecified	Enforcement of unspecified laws and regulations related to the protection of fish and wildlife or their habitats.
8.1.0	Partner/stakeholder engagement strategies	Engagement of partners to achieve shared objectives and broader coordination across overlapping areas.
8.2.3	Recruitment and retention activities: Wildlife watching	Participation in programs intended to recruit and retain wildlife watchers Note: this activity has limited eligibility for funding through WSFR grant programs.
8.3.0	WSFR program/subprogram outreach strategies	Provision of educational information on WSFR grants and grant programs to target audiences.
9.1.0	Land use planning strategies	Leading or participating in land use planning for rural, urban or agricultural lands.
9.2.1	Organizational strategic and operational planning	Development of agency strategic and operational plans Note: Does not include actions to implement plans.
9.3.1	Species management planning	Development of management plans for fish and wildlife species (e.g., interjurisdictional fisheries management planning).
9.3.3	Habitat management planning	Development of management plans for habitats and natural processes (e.g., management planning for longleaf pine habitat; Habitat Conservation Plan development).
11.1.1	Environmental review: Review of proposed projects	Review of proposed development projects to help ensure that impacts to fish and wildlife are minimized and resource benefits are maximized.
11.1.2	Environmental review: Review of proposed policies and plans	Review of non-conservation oriented policies and plans to help ensure that impacts to fish and wildlife are minimized and resource benefits are maximized (e.g., review of harbor dredging plan, review of state highway plans).
11.2.0	Assorted technical assistance strategies	Provision of professional training and technical assistance to others on fish and wildlife assessment and management.
11.2.1	Technical assistance: With individuals and groups involved in resource management decision making	Provision of professional training and technical assistance on fish and wildlife assessment and management to individuals and groups involved in resource management decision-making (e.g., provide agency-collected data to other governmental officials, train non-governmental organizations on new trapping methods, review of conservation-oriented policies and plans).
11.2.2	Technical assistance: Private landowners	Provision of technical assistance on fish and wildlife management practices to private landowners Note: Could Include development and delivery of economic incentives to private landowners to influence responsible stewardship of land/water and specific species.
100.1.2	Legislation: National Level	A directive proposed by a legislative body (bills, laws, acts, statutes) within the federal government.
100.1.3	Legislation: Sub-national Level	A directive proposed by a legislative body (bills, laws, acts, statutes) within a state or sub-national legislative body.
100.1.4	Legislation: County and Local	A directive proposed by a legislative body (bills, laws, acts, statutes) within County or local government.
100.1.5	Legislation: Scale Unspecified	A directive proposed by a legislative body (bills, laws, acts, statutes) at an unspecified level of government.
100.3.0	State regulations: Regulatory initiatives for species and habitat	Specific regulatory initiatives directed at the protection of fish and wildlife and/or their habitats.

Table 4 (conservation actions) continued

TRACS Level3 ID	TRACS Level 3 Category	TRACS Level 3 Category Definition/Description
100.3.2	State regulations: State Land Acquisition Programs	Increase opportunities for habitat restoration by making any necessary policy changes to state land acquisition programs to facilitate acquisition of desirable fish and/or wildlife habitats.
100.4.0	State Agency Policy Integration: Policy initiatives for species and habitat protection	Specific policy initiatives directed at the protection of fish and wildlife and/or their habitats.

C. Future Prioritization of Conservation Actions

The extensive list of conservation actions addresses the highest priority threats discussed in section I.B and presented in Table 3. However, the DFW intends to work closely with conservation partners from 2018 to 2020 to further prioritize conservation actions using a more refined and detailed assessment that considers feasibility, cost, potential effectiveness, and other criteria. The results of this intensive evaluation will be integrated into a revised report, *Threats and Actions of Focal Species of Greatest Conservation Need,* as part of a future revision to this plan.

D. Addressing the Impacts of Climate Change on New Jersey's Wildlife and Their Habitats

The USFWS requires State Wildlife Action Plans to carefully consider the threats created and exacerbated by climate change and to assess actions that can be taken to address those threats. This section explores the approaches and actions that the NJDEP and conservation partners can take locally to address a global challenge.

The consequences of a changing climate, including sea level rise, are forecasted to pose significant threats to New Jersey's natural ecosystems and wildlife. Most climate change impacts will occur by influencing or intensifying many other existing unrelated threats.[30] Not knowing how and the degree to which these impacts will affect wildlife poses major challenges with respect to planning adaptive measures to address those effects. Making the challenge even greater, climate change is a global issue, so the steps needed to address its root causes (e.g., greenhouse gas emissions) are well beyond the purview of this state wildlife plan.
plan.

Fortunately, there is still work that can be completed on the state level to address the *effects* of climate change or to at least facilitate possible adaptations to those effects. Many of the strategies that will help reduce the effects of climate change on New Jersey's wildlife will improve the conditions for wildlife in general and improve their resiliency to a changing landscape. For example, habitat connectivity in coastal areas is a serious concern. Actions that address connectivity – whether in response to development or sea level rise – can yield real benefits to coastal species.

The NJDEP's Bureau of Energy & Sustainability has worked on several fronts to help address statewide climate change mitigation and adaptation concerns in collaboration with other NJDEP programs, other government agencies, and a variety of organizations across New Jersey. These efforts connect to on-going state, regional, and federal adaptation initiatives such as:

- piloting a coastal-community vulnerability assessment protocol;
- testing models of transportation infrastructure vulnerability (with support from the Federal Highways Administration); and
- developing adaptation planning and implementation tools for local governments (though a Sustainable Jersey Climate Adaptation Task Force co-chaired by the NJDEP).

In addition, New Jersey participates in on-going regional and federal adaptation initiatives such as the:

- Mid-Atlantic Ocean Council's identification of regional transportation infrastructure vulnerability to sea level rise and increased flood hazards;
- Northeastern States for Coordinated Air Use Management's adaptation workgroup, which is collaborating on region-wide adaptation issues (e.g., data collection and storage, shared frameworks, and communications);
- National Oceanic & Atmospheric Administration's Climate Ready Estuaries Program to address climate change in coastal areas and watersheds; and
- U.S. Environmental Protection Agency's State and Tribal Climate Change Council to address climate change adaptation issues relating to water.

At the state level, the NJDEP continues to be a strong leader in managing air and water pollution through reasonable and appropriate regulations, including regulations to protect water quality in important waterways that support sensitive species. Of particular note is the NJDEP's participation in the NJ Climate Adaptation Alliance, a Rutgers University-led effort that brings together diverse stakeholders to address climate change preparedness for public health; watersheds, rivers, and coastal communities; built infrastructure; agriculture; and natural resources. In addition, the Alliance is a clearinghouse for guides (such as *Resilience: Preparing NJ for Climate Change*) and tools, such as NJADAPT's Flood Mapper. The Flood Mapper allows users, whether government officials or interested citizens, to visualize coastal flood hazards and sea level rise. The Alliance also lists policy recommendations for the state.

New Jersey's conservation community acknowledges that long-term research and monitoring are required to better understand the effects of climate change on the state's wildlife and their habitats. Therefore, when appropriate, future research will address climate change threats and effects such as increased water temperatures, rising sea level, vegetation changes, changes in food source emergence (e.g., insects, seeds and fruits), changes in migratory routes and timing, and the appearance and disappearance of climate-sensitive species.

This 2017 Revised Plan addresses threats associated with climate change by accepting that there will be inevitable impacts (however difficult they are to precisely predict) and maximizing the ability of New Jersey's habitats and wildlife to adapt to them. To provide a foundation for climate-related actions in the revised plan, the DFW had VanLuven Environmental review, synthesize, and summarize scientific articles and analyses on climate change specifically related to New Jersey's wildlife. This review, entitled *Climate Change Summary for Wildlife Action Plan*, can be found in its entirety in Attachment III.

There are two broad approaches to adaptation. The first is to implement changes that *address and overcome the challenges of climate change*. Strategies include increasing connectivity between protected areas and other refugia, and sustaining ecological processes and functions.[31] This approach recognizes that while there will be major changes across the state, the emphasis is on protecting the species and the habitats that are in New Jersey now. The second approach, developed by Anderson and Ferree (2010), is to *protect the places with geophysical features that are most likely to support species richness regardless of climate change*. This approach can be more difficult for people to accept since it may mean letting go of certain high-risk species, possibly with the result of local extinctions.

The overarching threats at the landscape region scale include temperature changes (shifting temperatures may shuffle species compositions), precipitation and flooding (more intense precipitation can lead to more flooding and erosion in streams and rivers), drought and low stream flows (lower water levels could impede fish access), and sea-level rise (rising waters will lead to the inundation of beaches and marshes).[32]

Although the consequences of climate change and sea level rise are not yet fully understood, it is clear that New Jersey's wildlife populations and the habitats that support them are, and will continue to be, undergoing fundamental changes due to these threats. Stakeholders with a vested interest in protecting the state's wildlife may not be able to influence large-scale policy, such as limiting greenhouse gas emissions in other countries, but there are actions that can be taken to adapt to the impacts of climate change. At the same time, these strategies will help relieve other challenges that wildlife are facing, such as habitat fragmentation and pollution. A comprehensive, holistic approach to wildlife protection may represent the best opportunity for addressing both individual threats and their additive impacts.

E. Collaboration beyond New Jersey's Borders

Many, if not most, of the threats to wildlife and wildlife habitats are not local or unique to New Jersey, and many of the approaches to addressing these threats benefit greatly from collaboration at regional and landscape scales that result in more unified, consistent and effective actions and projects. The close proximity of many northeastern states has engendered a culture of cooperative and/or complementary management approaches. The Northeast Association of Fish and Wildlife Agencies traditionally has supported a strong technical committee structure to further wildlife conservation. Technical committees are species or habitat-focused groups that exchange ideas and develop common approaches to wildlife issues. Typically, these conservation actions are implemented by individual states using their own funds; however, in some cases additional funding has been made available through the Northeast Directors.

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[31] Staudinger *et al*, 2015
[32] VanLuven, 2015

The Regional Conservation Needs (RCN) program formalizes a cooperative approach to address SGCN needs across multiple states. The purpose of the RCN program is to develop, coordinate, and implement conservation actions that are regional/sub-regional in scope, and build upon the many regional initiatives that already exist. The RCN program utilizes a funding mechanism that is equitable to all Northeast states and the District of Columbia, creating a base of funding for regional projects. Since 2007, thirty-seven different projects have been supported through this program. The resulting reports and products can be found at RCNgrants.org. New Jersey will continue to participate in this and other regional-, watershed- and landscape- scale cooperative approaches to addressing SGCN and habitat conservation needs.

III. Threats and Conservation Actions for the Focal Species of Greatest Conservation Need Report

As described above, New Jersey's wildlife and their habitats face hundreds, if not thousands, of threats to their persistence and well-being. Many of these threats, along with the conservation actions necessary to alleviate their impacts, have been identified in this plan with an emphasis on Focal SGCN.

In this section, we briefly describe the report, *Threats and Conservation Actions for the Focal Species of Greatest Conservation Need* (Appendix J). This report provides extensive and highly detailed lists of threats and the applicable conservation actions for each of the 48 individual Focal SGCN and Focal SGCN guilds, referred to as "conservation targets." Plan users should consider this information when developing new or adapting on-going conservation projects. Additionally, if other species-based plans exist, they are cited within the *Profiles of the Focal Species of Greatest Conservation Need* (Appendix D), and such plans may provide additional management guidance.

This report was generated from a complex database developed and managed by the DFW. The DFW continues to work on the development and deployment of the database with an ultimate intent to make it publicly available and, perhaps, web-enabled. This greater accessibility would enable plan users to query for species, habitats, threats, actions, and geographic areas of interest.

The report identifies the conservation target, the Focal SGCN included within the target (if more than one), the associated threats, and applicable conservation actions. For the threats, the level 1-3 categories and New Jersey-specific statements (level 4) are presented in chronological order of their identification number. Each level 3 category is followed by the average impact rating of the Focal SGCN to help readers identify the issues of greatest concern (threat impact ratings are described in section I.B above, *Evaluation of Threats*). Similarly, applicable conservation actions are presented in chronological order of their identification number.

Excerpts from one conservation target (Allegheny woodrat) within the report, *Threats and Conservation Actions for the Focal Species of Greatest Conservation Need*, have been provided below to illustrate how this information is presented in the report; i.e., the taxonomic group, conservation target, the Focal SGCN within that conservation target (if more than one), the

threats and action drivers associated with the conservation target, and the conservation actions to address those threats and action drivers. Please see Appendix J for the *complete* report on Allegheny woodrat and the other 47 conservation targets.

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Mammals

Allegheny Woodrat

Focal species that comprise this Conservation Target:

Allegheny Woodrat

Threats and Action Drivers associated with this Conservation Target:

1 Residential and Commercial Development

1.1 Housing and Urban Areas

1.1.1 Land conversion from natural habitat to urban and other residential areas (large and small scale) (Avg. Score: 2.00)

NJ Specific Threats:
- 1.1.1.1 Fragments terrestrial and aquatic habitats making the area unsuitable for area-sensitive species and inhibit dispersal of animals, reducing gene flow.
- 1.1.1.2 Loss, alteration and/or degradation of habitat.
- 1.1.1.4 Increased risk of vehicle strikes/mortality to terrestrial-bound and some bird species.

1.2 Commercial and Industrial Areas

1.2.1 Land conversion from natural habitat to commercial or industrial areas (large and small scale) (Avg. Score: 2.00)

NJ Specific Threats:
- 1.2.1.1 Fragments terrestrial and aquatic habitats making the area unsuitable for area-sensitive species and inhibit dispersal of animals, reducing gene flow.
- 1.2.1.2 Loss, alteration and/or degradation of habitat.
- 1.2.1.4 Increased risk of vehicle strikes/mortality to terrestrial-bound and some bird species.

1.3 Tourism and Recreational Areas

1.3.1 Land conversion from natural habitat to recreation or tourism areas (large and small scale) (Avg. Score: 1.00)

NJ Specific Threats:
- 1.3.1.1 Fragments terrestrial and aquatic habitats making the area unsuitable for area-sensitive species and inhibit dispersal of animals, reducing gene flow.

3 Energy Production and Mining

3.1 Oil and Gas Facilities and Pipelines

3.1.1 Distribution processes of petroleum and other liquid hydrocarbons (Avg. Score: 1.00)

NJ Specific Threats:
- 3.1.1.1 Fragments terrestrial and aquatic habitats.
- 3.1.1.2 Loss, alteration and/or degradation of habitat.
- 3.1.1.3 Increased risk of oil spills.
- 3.1.1.4 Increased noise pollution.
- 3.1.1.5 Increased vehicular and ship traffic associated with construction and operations, and therefore an increased risk of wildlife mortality from strikes.

3.1.2 Natural gas distribution processes (Avg. Score: 1.00)

NJ Specific Threats:
- 3.1.2.1 Fragments terrestrial and aquatic habitats.
- 3.1.2.2 Loss, alteration and/or degradation of habitat.

14.2 Outreach needs

14.2.1 Need to improve specific understanding of agency/organization goals, objectives and ongoing wildlife conservation actions (Avg. Score: 2.00)

NJ Specific Threats: 14.2.1.1 Need to develop greater understanding of and support for efforts implemented to enhance SGCN habitat and biodiversity through various forest management practices.

15 Administrative Needs

15.2 Organizational/program planning needs

15.2.3 Need for multi-state, regional and landscape scale planning (Avg. Score: 3.00)

NJ Specific Threats: 15.2.3.1 State governance and financial structures can sometimes inhibit conservation planning and implementation at the regional and landscape-scales that are often more effective at setting priorities and meeting species and habitat conservation goals and objectives.

Actions to address the Threats and Action Drivers associated with this Conservation Target:

1 Coordination and Administration

1.2 Incentives

1.2.1 Incentives

1.2.1.2 Create incentives (non-monetary and/or monetary) for and programs to deliver those incentives to private and public landowners and land managers to increase the effective size of SGCN habitats by protecting/restoring adjacent habitats that contribute to the overall size of the "core" area and/or provide a natural buffer, enhancing the suitability of the core area for SGCN, and/or connect conserved SGCN habitats.

1.2.1.4 Secure and promote the protection, restoration, and/or development of old-growth forest stands with large trees, in particular those within large, contiguous forest tracts through incentive programs.

1.2.1.8 Create incentives (non-monetary and/or monetary) for and programs to deliver those incentives to municipalities, land developers, and other land managers to retain and/or enhance native vegetation adjacent to aquatic habitats, and along riparian areas and wildlife movement corridors.

1.2.1.9 Develop a new funding source, targeting natural resource damages monies, mitigation monies or other available sources, to fund new or existing Forestry Stewardship Programs.

1.2.1.14 Create incentives (non-monetary and/or monetary) for and programs to deliver those incentives to NJ landowners and land managers (including farmers, foresters and developers) for reducing or eliminating the use of herbicides and pesticides, and implementing more ecologically safe strategies when using such products.

1.2.1.15 Create incentives (non-monetary and/or monetary) for and programs to deliver those incentives to NJ landowners and land managers (including farmers, foresters and developers) for reducing or eliminating the use of rodenticides, and implementing more ecologically safe strategies when using such products.

1.2.1.20 Coordinate across government agencies and non-government organizations to create or expand upon tax-based incentive programs available to private, agricultural, commercial, industrial or governmental landowners and land managers to include or provide for incentives for the maintenance and/or improvement to existing habitat via the endorsement of wildlife-related BMP's.

2 Direct Management of Natural Resources

IV. Projects to Conserve New Jersey's Wildlife Populations of Concern Report

A. Organizing Actions around Issues and Needs

The three Action Development Workshops (described in section II.B above) delivered a wide-ranging list of actions, some of which were directed at overarching benefits to multiple SGCNs and their habitats, and some that were highly specific to individual species. The DFW assessed these actions and grouped them when they addressed a particular threat, a suite of related threats, or a conservation need. These groups of actions – or projects – were then divided into jobs that would collectively help accomplish the project.

From this assessment, the DFW developed the report, *Projects to Conserve New Jersey's Wildlife Populations of Concern* (Appendix K). The report lists 32 projects (Table 5) which include 102 jobs; note, one project and one job are under development. For each job, the report lists:

- Objectives & purpose
- Benefits
- Focal SGCN targeted by the job
- Threats and action drivers
- Conservation actions

The job for one project is presented below as an example of the information provided in this report. Please see Appendix K for the complete report.

While the report, *Threats and Conservation Actions for Focal Species of Greatest Conservation Need*, provides guidance for conservation organized around Focal SGCN, the report, *Projects to Conserve New Jersey's Wildlife Populations of Concern*, provides guidance for conservation organized around broad issues, threats, and needs. The *Projects to Conserve New Jersey's Wildlife Populations of Concern* report is not comprehensive or an exhaustive cataloging of conservation projects, nor does it purport to address all of the highest priority issues. Instead, it is simply a starting point for conservation partners that shows how related and interdependent conservation actions work together within a unified "project" to address overarching conservation needs. The information in the two reports is consistent, but the two different structures are intended to accommodate planning from different perspectives.

B. Future Prioritization of Projects

The DFW intends to work closely with conservation partners to more thoroughly prioritize threats and conservation actions, and to further develop and prioritize projects and jobs. This next phase of planning will be based on further assessment of the threats and applicable actions for Focal SGCN and their habitats, and assessment of threats and development of conservation actions based on Conservation Focal Areas. As projects are further developed and prioritized, performance metrics will be developed for high priority projects to measure success and provide adaptive management feedback. Such metrics will likely include quantities such as acres of habitat restored and occupied by target wildlife, population measurements, and reproductive success, that indicate the effectiveness of conservation actions. The measurable results will be used to adapt the projects and jobs to achieve success or develop new conservation actions.

Projects that are prioritized and revised to include performance metrics will form the revised *Projects to Conserve New Jersey's Wildlife Populations of Concern* report as part of a future revision to this plan.

Table 5. 32 Projects related to Focal SGCN

1. State Wildlife Action Plan Integration and Implementation (2 jobs)
2. Update Landscape Mapping (1 job)
3. Region-based Habitat Conservation Plans: Statewide (1 job)
4. Climate Change Impacts to New Jersey Wildlife and Residents (4 jobs)
5. Barriers to Conservation Efforts (2 jobs)
6. Coastal and Shoreline Stabilization (4 jobs)
7. Unify Coastal Landowners on Beach and Dune Management and Shoreline Stabilization Practices (1 job)
8. Coastal Marsh Migration (2 jobs)
9. Marsh Habitats in Trouble (6 jobs)
10. Best Management Practices (BMPs) to Benefit SGCN and their Habitats (5 jobs)
11. Habitat Management to Improve Ecological Diversity (10 jobs)
12. Habitat Management through Prescribed Burns (3 jobs)
13. Land Management Coordination on Military Properties (1 job)
14. Fostering Habitat in Urbanized/Suburbanized Areas (1 job)
15. Mapping Early Successional Habitat for Planning and Management (1 job)
16. Farming for Bobwhite Quail (1 job)
17. Habitat Connectivity (2 jobs)
18. Invasive and Non-native Species Control (6 jobs)
19. Invasive and Native Species Control (3 jobs)
20. Incentives to Encourage Wildlife Conservation Efforts (5 jobs)
21. Tax Structure for Conservation (1 job under development)
22. Habitat Protection (5 jobs)
23. Land Use Planning (4 jobs)
24. Marine Protection (3 jobs)
25. Fisheries Management (1 job)
26. Pollutants Come in Many Forms (4 jobs)
27. Research and Monitoring (8 jobs)
28. Harvests, By-catch and Impingement (4 jobs)
29. Limiting Effects of Predators (1 job)
30. Do Not Disturb the Birds (2 jobs)
31. Aquaculture, Wildlife and Habitat (5 jobs)
32. Education and Outreach (3 jobs)

Project 29. Limiting Effects of Predators

Job 29.01. Reducing the Impacts of Predators on Beach Nesting Species

Objective: Decrease the impact of predator populations at and adjacent to critical areas for beach dependent wildlife by implementing predator management strategies, including including exclusionary tactics, aversive conditioning, and removal.

Purpose: Decreasing the predation pressure on beach dependent wildlife to result in an increase in adult survival, hatch success, and productivity.

Benefits: Increased reproductive success and survival of beach dependent wildlife.

Focal wildlife species benefitting from this job

Birds

American Oystercatcher | Black Skimmer | Common Tern

Least Tern | Piping Plover | Red Knot

Ruddy Turnstone

Reptiles & Amphibians

Northern Diamondback Terrapin

Threats and Action Drivers associated with this conservation need

8 Invasive and Other Problematic Species, Genes and Diseases

8.1 Invasive Non-native/ Alien Species/ Diseases

8.1.4 Invasive non-native terrestrial/wetland animals

8.1.4.2 Free-roaming and feral domestic animals such as cats and dogs causes direct mortality of wildlife and disturbance to wildlife breeding and resting areas.

8.2 Problematic Native Species/Diseases

8.2.2 Named Species

8.2.2.2 Human-subsidized native species can become overabundant, increasing predation on other native wildlife and/or altering the ecological community.

Conservation actions that address Threats and Action Drivers

2 Direct Management of Natural Resources

2.13 Wildlife damage management

2.13.0 Nuisance fish and wildlife damage

2.13.0.6 Develop, implement and evaluate the effectiveness of predator-control techniques aimed at improving SGCN populations and methods to minimize the impact of those species carrying parasites or diseases that may impact SGCN (e.g., raccoon roundworm kills Allegheny woodrat).

3 Data Collection and Analysis

3.2 Research, survey or monitoring - fish and wildlife populations

3.2.0 Data deficiency

3.2.0.22 Evaluate the effectiveness of predator-control techniques aimed at improving SGCN populations and methods to minimize the impact of those species carrying parasites or diseases that may impact SGCN (e.g., raccoon roundworm kills Allegheny woodrat).

8 Outreach

8.1 Partner/stakeholder engagement

8.1.0 Partner/stakeholder engagement strategies

8.1.0.21 Work with government agencies and environmental educators to develop educational resources and training programs, educate the public on the devastation human-subsidized and/or overabundant, native species cause to local nesting species, and provide expert guidance on how residents can help alleviate this threat.

8.1.0.22 Work with government agencies and environmental educators to develop educational resources and training programs, educate the public on the devastation invasive species cause to native nesting species, and provide expert guidance on how residents can help alleviate this threat.

8.3 WSFR program/subprogram outreach

8.3.0 WSFR program/subprogram outreach strategies

8.3.0.6 Develop and provide (or otherwise make publicly available) educational programs and/or materials to enlist landowners, land managers and local communities to discourage the presence of managed cat colonies and trap, neuter and release programs in wildlife habitats.

8.3.0.19 Develop an educational outreach program for the public on the devastating effects predators can have on native nesting wildlife.

9 Planning

9.3 Species and habitat management planning

9.3.1 Species management planning

9.3.1.11 Develop a management plan using predator-control techniques aimed at improving SGCN populations and methods to minimize the impact of those species carrying parasites or diseases that may impact SGCN (e.g., raccoon roundworm kills Allegheny woodrat).

V. Future Work with Conservation Focal Areas

As noted in Chapter 2, "Habitats of New Jersey," delineation of Conservation Focal Areas (CFAs) represents the second of a two-part approach to identifying and understanding threats to New Jersey's Species of Greatest Conservation Need (SGCN) and developing actions that will address these threats. The CFAs highlight specific areas of New Jersey that feature some of the highest value wildlife habitats and/or present greater opportunities for effective conservation action. In combination with Focal SGCN, conservation actions in CFAs will benefit virtually *all* SGCN and, in turn, all of New Jersey's wildlife. Also, by highlighting specific areas of New Jersey's landscapes for effective conservation actions, to the extent that conservation partners choose to use the CFA maps to guide the selection of areas to implement conservation actions, those actions will be directed towards a variety of "conservation target rich" areas that will benefit *all* wildlife, not just those that appear in the plan as "focal species."

Following a re-examination and possible refinement of CFAs (see Chapter 2), the DFW will undertake a more geographically specific examination of threats and development of actions targeted at the greatest threats to those areas.

Any future re-examination and modification of CFAs will include evaluation of the Northeast Regional Conservation Opportunity Areas, now called "Nature's Network."[33] Completion of CHANJ mapping and guidance, described in the Introduction, in Section IV.A, *Connecting Habitats Across New Jersey (CHANJ)*, and in Chapter 2, Section I.B, *Use and Future Development of CFAs*, is anticipated in the next year (2018), and the results of that assessment may also be included in any possible re-configuration of CFAs. Whether these or other ongoing geographically specific assessments of habitat are used to modify CFAs, they will be included in future planning to, especially planning that will direct conservation actions at specific locations within the state. The CHANJ products, for example, will provide geographically specific guidelines for addressing the threats posed by roads and other forms of habitat fragmentation, and these guidelines will be incorporated into future revisions of this Plan just as Landscape Project products currently are.

VI. Integrating Flora and Natural Communities as Important Components of Biological Diversity

This plan explicitly focuses on the development and implementation of actions to conserve SGCN and the habitats on which they depend. Although plants are not addressed as species of conservation concern in the plan, New Jersey supports extraordinarily diverse flora of more than 2,140 native taxa, including 818 rare plants of which 356 are listed as state endangered. Ecological communities provide important habitats for these rare plants in addition to SGCN.

Most of the threats confronting New Jersey's wildlife populations similarly affect its native flora and ecological communities. The actions, projects, and monitoring programs presented in this plan for wildlife also provide an opportunity to conserve these other important elements of biological diversity. At the same time, without proper precautions, actions directed at enhancing wildlife, especially on-the-ground actions that modify habitats, may pose risks to rare plants.

In recognition of this challenge, the DFW partnered with the New Jersey Natural Heritage Program, the NJDEP's plant conservation program, to develop guidance for integrating plant species of conservation concern into wildlife planning and action implementation. The resulting report focuses on four habitat types within two landscape regions that are critical to a suite of plant and wildlife species, and provides examples of how to integrate rare plant and wildlife conservation planning and adaptive management. The report, presented in Attachment IV (Part 1), follows the geographic organization of the 2008 Revised Plan.

Attachment IV (Part 2) also includes tables indicating occurrences of plants of conservation concern by landscape regions and broad habitat categories.